

The Claims Defining the Invention are as Follows

1. A system for synchronising stations in a communications network comprising:

at least one airborne or space-based vehicle; and

5 at least two stations, each station having receiver means in data communication with the at least one airborne or space-based vehicle and control means in data communication with the receiver means and in control communication with a communication means,

where, when each receiver means receives a synchronisation signal from the at least one airborne or space-based vehicle:

10 each receiver means forwards the synchronisation signal to its respective control means;

each control means processes the synchronisation signal to determine the operational frequency required by its respective communication means to maintain or establish communication with the other station; and

15 each control means controls its respective communication means to change to the determined operational frequency.

2. A system for synchronising stations in a communications network according to claim 1, where processing of the synchronisation signal includes iterating a pseudo-random algorithm on receipt of the synchronisation signal and determining the operational frequency based on the iterated value of the pseudo-random algorithm.

25 3. A system for synchronising stations in a communications network according to claim 2, where a frequency range of each communication means is determined from at least a part of an initial code, the initial code being the initial value of the pseudo-random algorithm.

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4. A system for synchronising stations in a communications network according to any preceding claim, where the operable frequency spectrum is divided into a set of hopping bands, the start frequency of each hopping band being stored in a reference table.
5. A system for synchronising stations in a communications network according to claim 4, as dependent on claim 3, where each hopping band has a range equal to the determined frequency range.
6. A system for synchronising stations in a computer system according to claim 4 or claim 5, as dependent on claim 2 and claim 3, where the operational frequency required by the communication means to maintain or establish communication with the other station is determined according to the formula:

$$F = F_b + (C \times F_r) / Y$$

where:

F = the new operational frequency

15 F_b = the start frequency of the hopping band currently being used for transmission, as determined by values stored in reference table;

C = the present value of the pseudo-random algorithm, or a part thereof;

F_r = the maximum allowable range of frequency hop in Hz; and

$Y = 2^{(\text{the number of bits used by } C)}$

20 7. A system for synchronising stations in a computer system according to claim 6, where $Y = 256$.

25 8. A system for synchronising stations in a communications network according to claim 2, where the iterated value of the pseudo-random algorithm is cross-referenced with a frequency table to determine the operational frequency required to maintain or establish communication with the other station.

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9. A system for synchronising stations in a communications network according to any one of claims 2 to 8, as dependent on claim 2, where each station includes a synchronisation unit for emitting a synchronisation pulse, and where the synchronisation signal includes time information, the time information being used to calibrate the synchronisation unit and the pseudo-random algorithm being iterated on receipt of each synchronisation pulse.
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10. A system for synchronising stations in a communications network according to claim 9, where the synchronisation unit emits a predetermined number of synchronisation pulses (R) a second.
- 10 11. A system for synchronising stations in a communications network according to claim 10, where R is in the range $5 \leq R \leq 10$.
12. A system for synchronising stations in a communications network according to claim 11, where $R = 5$.
13. A system for synchronising stations in a communications network according to
15 any one of claims 2 to 12, as dependent on claim 2, where, when a new station joins the communications network, synchronisation of the new station with existing stations is attained by setting the value of the pseudo-random algorithm to the initial code and iterating the pseudo-random algorithm according to the formula:
- 20 $I = S \times R$
- where:
- 1 = number of iterations of the pseudo-random algorithm to be performed;
- 20 S = number of seconds that have passed since the last predetermined amount of time elapsed; and
- 25 R = the predetermined number of synchronisation pulses a second.

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14. A system for synchronising stations in a communications network according to any one of claims 2 to 13, as dependent on claim 2, where after a predetermined amount of time the pseudo-random algorithm resets its value to equal an initial code, the initial code being the initial value of the pseudo-random algorithm.
- 5 15. A system for synchronising stations in a communications network according to claim 14, where the predetermined amount of time is 24 hours.
- 10 16. A system for synchronising stations in a communications network according to claim 15 and any one of claims 10 to 12, where the pseudo-random algorithm performs at least $86400 \times R$ iterations before repeating.
17. A system for synchronising stations in a communications network according to claim 4, where the control means operates to avoid determining an operational frequency falling within at least one predetermined hopping band.
18. A system for synchronising stations in a communications network according to 15 any one of claims 2 to 17, as dependent on claim 2, where the pseudo-random algorithm is at least a 31 bit algorithm.
19. A system for synchronising stations in a communications network according to any one of claims 2 to 18, as dependent on claim 2, where, when the pseudo-random algorithm has a value equal to an initial code, the initial code being the initial value of the pseudo-random algorithm, the control means operates 20 to iterate the pseudo-random algorithm a predetermined number of times.
20. A system for synchronising stations in a communications network according to any one of claims 2 to 19, as dependent on claim 2, where the pseudo-random algorithm is based on the Digital Encryption Standard algorithm.
- 25 21. A system for synchronising stations in a communications network according to claim 1, where the synchronisation signal includes time information and the time information is cross-referenced with a frequency table to determine the

operational frequency required to maintain or establish communication with the other station.

22. A system for synchronising stations in a communications network according to any preceding claim, where the communication means is a transceiver;
- 5 23. A system for synchronising stations in a communications network according to any one of claims 1 to 21, where the communication means of at least one station is a transmitter or transceiver and the communication means of at least one station is a receiver.
- 10 24. A system for synchronising stations in a communications network according to any preceding claim, where the at least one airborne or space-based vehicle is the global positioning system network of satellites.
25. A system for synchronising stations in a communications network according to any one of claims 1 to 23, where the at least one airborne or space-based vehicle is a geosynchronous satellite.
- 15 26. A system for synchronising stations in a communications network according to any one of claims 2 to 26, as dependent on claim 2, where each station includes a data input means, data input using the data input means operable to seed the pseudo-random algorithm with an initial value.
- 20 27. A system for synchronising stations in a communications network according to any preceding claim, where each station also has a unique identification code and where, when one station, a calling station, communicates with another station, a receiving station:
the calling station transmits a communication message including the unique identification codes of the calling station and receiving station on each frequency in a predetermined set of frequencies, commencing with the operational frequency;
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- the receiving station records a value of at least one attribute in respect of the transmission signal encapsulating the communication message for each frequency in the predetermined set of frequencies;
- 5 the receiving station sends a reply communication message including the unique identification codes of the calling station and receiving station on the frequency having the best recorded value or best combination of recorded values; and
- 10 the calling station scans each frequency in the predetermined set of frequencies until the frequency on which the reply communication message has been sent is received, communications between calling station and receiving station thereafter continuing on that frequency.
28. A system for synchronising stations in a communications network according to claim 27, where the calling station transmits a communication message including the unique identification codes of the calling station and receiving station on each frequency in a predetermined set of frequencies twice and where the receiving station records the best value of the at least one attribute in respect of the two transmission signals encapsulating the communication message for each frequency in the predetermined set of frequencies.
- 15 29. A system for synchronising stations in a communications network according to claim 27 or claim 28, where the at least one attribute includes is at least one of the following: signal strength; bit error rate.
- 20 30. A station for use in a system for synchronising stations in a communication network according to any preceding claim.
31. A method of synchronising stations in a communications network comprising:
- 25 receiving, at a first station, a synchronisation signal from at least one airborne or space-based vehicle;

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processing the synchronisation signal to determine the operational frequency required to maintain or establish communication with another station; and

5 changing a communication means to communicate on the operational frequency.

32. A method of synchronising stations in a communications network according to claim 31, including the step of iterating a pseudo-random algorithm on receipt of the synchronisation signal and the step of processing the synchronisation signal determines the operational frequency based on the iterated value of the 10 pseudo-random algorithm.
33. A method of synchronising stations in a communications network according to claim 32, including the step of determining a frequency range for the communication means from at least a part of an initial code, the initial code being the initial value of the pseudo-random algorithm.
- 15 34. A method of synchronising stations in a communications network according to any one of claims 31 to 33, including the steps of dividing the operable frequency spectrum into a set of hopping bands and storing the start frequency of each hopping band stored in a reference table.
- 20 35. A method of synchronising stations in a communications network according to claim 34, as dependent on claim 33, where the step of dividing the operable frequency spectrum into a set of hopping bands involves dividing the operable frequency spectrum into a set of hopping bands equal having a range equal to the determined frequency range.
- 25 36. A method of synchronising stations in a communications network according to claim 34 or claim 35, as dependent on claim 32 or claim 33, where the step of determining the operational frequency is determined according to the formula:

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$$F = F_b + (C \times Fr) / Y$$

where:

F = the new operational frequency

5 F_b = the start frequency of the hopping band currently being used for transmission, as determined by values stored in reference table;

C = the present value of the pseudo-random algorithm, or a part thereof;

Fr = the maximum allowable range of frequency hop in Hz; and

Y = 2^(the number of bits used by C)

37. A method of synchronising stations in a communications network according to
10 claim 32, where the step of determining the operational frequency includes the
sub-step of cross-referencing the iterated value of the pseudo-random
algorithm with a frequency table.
38. A method of synchronising stations in a communications network according to
any one of claims 32 to 37, as dependent on claim 32, including the steps of
15 calibrating a synchronisation unit using time information included in the
synchronisation signal; and iterating the pseudo-random algorithm on receipt
of a synchronisation pulse emitted by the synchronisation unit.
39. A method of synchronising stations in a communications network according to
claim 38, including the step of emitting a predetermined a predetermined
20 number of synchronisation pulses (R) a second.
40. A method of synchronising stations in a communications network according to
claim 39, where R is in the range $5 \leq R \leq 10$.
41. A method of synchronising stations in a communications network according to
claim 40, where R = 5.

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42. A method of synchronising stations in a communications network according to any one of claims 32 to 41, as dependent on claim 32, including the step of synchronising a new station with existing stations in the communications network by setting the value of the pseudo-random algorithm to an initial code and iterating the pseudo-random algorithm according to the formula:
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$$I = S \times R$$

where:

I = number of iterations of the pseudo-random algorithm to be performed;

10 S = number of seconds that have passed since the last predetermined amount of time elapsed; and

R = the predetermined number of synchronisation pulses a second.

43. A method of synchronising stations in a communications network according to any one of claims 32 to 42, as dependent on claim 32, including the step of resetting the value of the pseudo-random algorithm to equal an initial code, the initial code being the initial value of the pseudo-random algorithm, after a predetermined amount of time.
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44. A method of synchronising stations in a communications network according to claim 42, where the predetermined amount of time is 24 hours.

45. A method of synchronising stations in a communications network according to 20 claim 34, including the step of avoiding determining an operational frequency falling within at least one predetermined hopping band.

46. A method of synchronising stations in a communications network according to any one of claims 32 to 45, as dependent on claim 32, including the step of 25 iterating the pseudo-random algorithm a predetermined number of times when the pseudo-random algorithm has a value equal to an initial code, the initial code being the initial value of the pseudo-random algorithm.

47. A method of synchronising stations in a communications network according to claim 31, the step of determining the operational frequency includes the sub-step of cross-referencing time information included in the synchronisation signal with a frequency table.
- 5 48. A method of synchronising stations in a communications network according to any one of claims 32 to 47, as dependent on claim 32, including the step of seeding the pseudo-random algorithm with an initial value using data input means.
49. A method of synchronising stations in a communications network according to
10 any one of claims 31 to 48, including the steps of:
- transmitting a communication message including a unique identification code of a calling station and of a receiving station on each frequency in a predetermined set of frequency, commencing with the operational frequency;
- 15 15 scanning each frequency in the predetermined set of frequencies for a reply communication message including the unique identification codes of the calling station and receiving station;
- receiving the reply communication message on a frequency having the best recorded value or best combination of recorded values, as determined by a value recorded by the receiving station of at least one attribute in respect of the transmission signal encapsulating the communication message for each frequency in the predetermined set of frequencies; and
- 20 20 communicating with the receiving station on the frequency having the best recorded value or best combination of recorded values.
- 25 50. A method of synchronising stations in a communications network according to any one of claims 31 to 48, including the steps of:

receiving a communication message including a unique identification code of a calling station and of a receiving station on each frequency in a predetermined set of frequencies, commencing with the operational frequency;

5 recording a value of at least one attribute in respect of the transmission signal encapsulating the communication message for each frequency in the predetermined set of frequencies;

10 sending a reply communication message including the unique identification codes of the calling station and receiving station on the frequency having the best recorded value or best combination of recorded values; and

communicating with the calling station on the frequency having the best recorded value or best combination of recorded values.

51. A method of synchronising stations in a communications network according to claim 49, where the step of transmitting a communication message including a unique identification code of a calling station and of a receiving station on each frequency in a predetermined set of frequency, commencing with the operational frequency is repeated twice.

52. A method of synchronising station in a communications network according to claim 50, where the step of receiving a communication message including a unique identification code of a calling station and of a receiving station on each frequency in a predetermined set of frequencies, commencing with the operational frequency is repeated twice and the step of recording a value of at least one attribute in respect of the transmission signal encapsulating the communication message for each frequency in the predetermined set of frequencies operates to record the best of the two values.

53. A method of synchronising station in a communications network according to any one of claims 49 to 52, where the at least one attribute includes is at least one of the following: signal strength; bit error rate.

54. A system for synchronising stations in a communications network substantially as described herein with reference to the drawings.
55. A method of synchronising stations in a communications network substantially as described herein with reference to the drawings.
56. A station for use in a system for synchronising stations in a communications network substantially as described herein with reference to the drawings.

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